

## Exercise 8.1

Which of the following are quadratic equations?

(i)  $x^2 + 6x - 4 = 0$

**Solution:**

Let  $p(x) = x^2 + 6x - 4$ ,

It's clearly seen that  $p(x) = x^2 + 6x - 4$  is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(ii)  $\sqrt{3}x^2 - 2x + 1/2 = 0$

**Solution:**

Let  $p(x) = \sqrt{3}x^2 - 2x + 1/2$ ,

It's clearly seen that  $p(x) = \sqrt{3}x^2 - 2x + 1/2$  having real coefficients is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(iii)  $x^2 + 1/x^2 = 5$

**Solution:**

Given,

$$x^2 + 1/x^2 = 5$$

On multiplying by  $x^2$  on both sides we have,

$$x^4 + 1 = 5x^2$$

$$\Rightarrow x^4 - 5x^2 + 1 = 0$$

It's clearly seen that  $x^4 - 5x^2 + 1$  is not a quadratic polynomial as its degree is 4. Thus, the given equation is not a quadratic equation.

(iv)  $x - 3/x = x^2$

**Solution:**

Given,

$$x - 3/x = x^2$$

On multiplying by  $x$  on both sides we have,

$$x^2 - 3 = x^3$$

$$\Rightarrow x^3 - x^2 + 3 = 0$$

It's clearly seen that  $x^3 - x^2 + 3$  is not a quadratic polynomial as its degree is 3. Thus, the given equation is not a quadratic equation.

(v)  $2x^2 - \sqrt{3x} + 9 = 0$

**Solution:**

It's clearly seen that  $2x^2 - \sqrt{3x} + 9$  is not a polynomial because it contains a term involving  $x^{1/2}$ , where  $1/2$  is not an integer. Thus, the given equation is not a quadratic equation.

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(vi)  $x^2 - 2x - \sqrt{x} - 5 = 0$

**Solution:**

It's clearly seen that  $x^2 - 2x - \sqrt{x} - 5$  is not a polynomial because it contains a term involving  $x^{1/2}$ , where  $1/2$  is not an integer. Thus, the given equation is not a quadratic equation.

(vii)  $3x^2 - 5x + 9 = x^2 - 7x + 3$

**Solution:**

Given,

$$3x^2 - 5x + 9 = x^2 - 7x + 3$$

On simplifying the equation, we have

$$2x^2 + 2x + 6 = 0$$

$$\Rightarrow x^2 + x + 3 = 0 \text{ (dividing by 2 on both sides)}$$

Now, it's clearly seen that  $x^2 + x + 3$  is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(viii)  $x + 1/x = 1$

**Solution:**

Given,

$$x + 1/x = 1$$

On multiplying by  $x$  on both sides we have,

$$x^2 + 1 = x$$

$$\Rightarrow x^2 - x + 1 = 0$$

It's clearly seen that  $x^2 - x + 1$  is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(ix)  $x^2 - 3x = 0$

**Solution:**

$$\text{Let } p(x) = x^2 - 3x,$$

It's clearly seen that  $p(x) = x^2 - 3x$  is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(x)  $(x + 1/x)^2 = 3(x + 1/x) + 4$

**Solution:**

Given,

$$(x + 1/x)^2 = 3(x + 1/x) + 4$$

$$\Rightarrow x^2 + 1/x^2 + 2 = 3x + 3/x + 4$$

$$\Rightarrow x^4 + 1 + 2x^2 = 3x^3 + 3x + 4x^2$$

$$\Rightarrow x^4 - 3x^3 - 2x^2 - 3x + 1 = 0$$

Now, it's clearly seen that  $x^4 - 3x^3 - 2x^2 - 3x + 1$  is not a quadratic polynomial since its degree is 4. Thus, the given equation is not a quadratic equation.

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(xi)  $(2x + 1)(3x + 2) = 6(x - 1)(x - 2)$

**Solution:**

Given,

$$(2x + 1)(3x + 2) = 6(x - 1)(x - 2)$$

$$\Rightarrow 6x^2 + 4x + 3x + 2 = 6x^2 - 12x - 6x + 12$$

$$\Rightarrow 7x + 2 = -18x + 12$$

$$\Rightarrow 25x - 10 = 0$$

Now, it's clearly seen that  $25x - 10$  is not a quadratic polynomial since its degree is 1. Thus, the given equation is not a quadratic equation.

(xii)  $x + 1/x = x^2, x \neq 0$

**Solution:**

Given,

$$x + 1/x = x^2$$

On multiplying by  $x$  on both sides we have,

$$x^2 + 1 = x^3$$

$$\Rightarrow x^3 - x^2 - 1 = 0$$

Now, it's clearly seen that  $x^3 - x^2 - 1$  is not a quadratic polynomial since its degree is 3. Thus, the given equation is not a quadratic equation.

(xiii)  $16x^2 - 3 = (2x + 5)(5x - 3)$

**Solution:**

Given,

$$16x^2 - 3 = (2x + 5)(5x - 3)$$

$$16x^2 - 3 = 10x^2 - 6x + 25x - 15$$

$$\Rightarrow 6x^2 - 19x + 12 = 0$$

Now, it's clearly seen that  $6x^2 - 19x + 12$  is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(xiv)  $(x + 2)^3 = x^3 - 4$

**Solution:**

Given,

$$(x + 2)^3 = x^3 - 4$$

On expanding, we get

$$\Rightarrow x^3 + 6x^2 + 8x + 8 = x^3 - 4$$

$$\Rightarrow 6x^2 + 8x + 12 = 0$$

Now, it's clearly seen that  $6x^2 + 8x + 12$  is a quadratic polynomial. Thus, the given equation is a quadratic equation.

(xv)  $x(x + 1) + 8 = (x + 2)(x - 2)$

**Solution:**

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Given,

$$x(x + 1) + 8 = (x + 2)(x - 2)$$

$$x^2 + x + 8 = x^2 - 4$$

$$\Rightarrow x + 12 = 0$$

Now, it's clearly seen that  $x + 12$  is not a quadratic polynomial since its degree is 1. Thus, the given equation is not a quadratic equation.

**2. In each of the following, determine whether the given values are solutions of the given equation or not:**

**(i)  $x^2 - 3x + 2 = 0$ ,  $x = 2$ ,  $x = -1$**

**Solution:**

Here we have,

$$\text{LHS} = x^2 - 3x + 2$$

Substituting  $x = 2$  in LHS, we get

$$(2)^2 - 3(2) + 2$$

$$\Rightarrow 4 - 6 + 2 = 0 = \text{RHS}$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

Thus,  $x = 2$  is a solution of the given equation.

Similarly,

Substituting  $x = -1$  in LHS, we get

$$(-1)^2 - 3(-1) + 2$$

$$\Rightarrow 1 + 3 + 2 = 6 \neq \text{RHS}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

Thus,  $x = -1$  is not a solution of the given equation.

**(ii)  $x^2 + x + 1 = 0$ ,  $x = 0$ ,  $x = 1$**

**Solution:**

Here we have,

$$\text{LHS} = x^2 + x + 1$$

Substituting  $x = 0$  in LHS, we get

$$(0)^2 + 0 + 1$$

$$\Rightarrow 1 \neq \text{RHS}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

Thus,  $x = 0$  is not a solution of the given equation.

Similarly,

Substituting  $x = 1$  in LHS, we get

$$(1)^2 + 1 + 1$$

$$\Rightarrow 3 \neq \text{RHS}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

Thus,  $x = 1$  is not a solution of the given equation.

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(iii)  $x^2 - 3\sqrt{3}x + 6 = 0$ ,  $x = \sqrt{3}$  and  $x = -2\sqrt{3}$

**Solution:**

Here we have,

$$\text{LHS} = x^2 - 3\sqrt{3}x + 6$$

Substituting  $x = \sqrt{3}$  in LHS, we get

$$(\sqrt{3})^2 - 3\sqrt{3}(\sqrt{3}) + 6$$

$$\Rightarrow 3 - 9 + 6 = 0 = \text{RHS}$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

Thus,  $x = \sqrt{3}$  is a solution of the given equation.

Similarly,

Substituting  $x = -2\sqrt{3}$  in LHS, we get

$$(-2\sqrt{3})^2 - 3\sqrt{3}(-2\sqrt{3}) + 6$$

$$\Rightarrow 12 + 18 + 6 = 36 \neq \text{RHS}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

Thus,  $x = -2\sqrt{3}$  is not a solution of the given equation.

(iv)  $x + 1/x = 13/6$ ,  $x = 5/6$ ,  $x = 4/3$

**Solution:**

Here we have,

$$\text{LHS} = x + 1/x$$

Substituting  $x = 5/6$  in LHS, we get

$$(5/6) + 1/(5/6) = 5/6 + 6/5$$

$$\Rightarrow 61/30 \neq \text{RHS}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

Thus,  $x = 5/6$  is not a solution of the given equation.

Similarly,

Substituting  $x = 4/3$  in LHS, we get

$$(4/3) + 1/(4/3) = 4/3 + 3/4$$

$$\Rightarrow 25/12 \neq \text{RHS}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

Thus,  $x = 4/3$  is not a solution of the given equation.

(v)  $2x^2 - x + 9 = x^2 + 4x + 3$ ,  $x = 2$ ,  $x = 3$

**Solution:**

Here we have,

$$2x^2 - x + 9 = x^2 + 4x + 3$$

$$\Rightarrow x^2 - 5x + 6 = 0$$

$$\text{LHS} = x^2 - 5x + 6$$

Substituting  $x = 2$  in LHS, we get

$$(2)^2 - 5(2) + 6$$

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$\Rightarrow 4 - 10 + 6 = 0 = \text{RHS}$   
 $\Rightarrow \text{LHS} = \text{RHS}$   
Thus,  $x = 2$  is a solution of the given equation.

Similarly,

Substituting  $x = 3$  in LHS, we get

$$(3)^2 - 5(3) + 6$$

$\Rightarrow 9 - 15 + 6 = 0 = \text{RHS}$

$\Rightarrow \text{LHS} = \text{RHS}$

Thus,  $x = 3$  is a solution of the given equation.

(vi)  $x^2 - \sqrt{2}x - 4 = 0$ ,  $x = -\sqrt{2}$ ,  $x = -2\sqrt{2}$

**Solution:**

Here we have,

$$\text{LHS} = x^2 - \sqrt{2}x - 4$$

Substituting  $x = -\sqrt{2}$  in LHS, we get

$$(-\sqrt{2})^2 - \sqrt{2}(-\sqrt{2}) - 4$$

$\Rightarrow 4 + 2 - 4 = 2 \neq \text{RHS}$

$\Rightarrow \text{LHS} \neq \text{RHS}$

Thus,  $x = -\sqrt{2}$  is a solution of the given equation.

Similarly,

Substituting  $x = -2\sqrt{2}$  in LHS, we get

$$(-2\sqrt{2})^2 - \sqrt{2}(-2\sqrt{2}) - 4$$

$\Rightarrow 8 + 4 - 4 = 8 \neq \text{RHS}$

$\Rightarrow \text{LHS} \neq \text{RHS}$

Thus,  $x = -2\sqrt{2}$  is not a solution of the given equation.

(vii)  $a^2x^2 - 3abx + 2b^2 = 0$ ,  $x = a/b$ ,  $x = b/a$

**Solution:**

We have,

$$\text{LHS} = a^2x^2 - 3abx + 2b^2 \text{ and } \text{RHS} = 0$$

Substituting the  $x = \frac{a}{b}$  and  $x = \frac{b}{a}$  in

$$\text{LHS} = a^2 \left(\frac{a}{b}\right)^2 - 3ab \left(\frac{a}{b}\right) + 2b^2$$

$$= \frac{a^4}{b^2} - 3a^2 + 2b^2$$

$\neq \text{RHS}$

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And, for  $x = b/a$

$$\text{LHS} = a^2 \left(\frac{b}{a}\right)^2 - 3ab \left(\frac{b}{a}\right) + 2b^2$$

$$= b^2 - 3b^2 + 2b^2 = 0$$

= RHS

Therefore,  $x = b/a$  is a solution of the given equation.

